

# **Representation of the Gastrointestinal Endoscopy Minimal Standard Terminology© in the SNOMED DICOM Microglossary**

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*In Gastroenterology, endoscopic images and interpretation reports are essential elements of the patient record. The Digital Imaging and Communications in Medicine (DICOM) Visible Light and Structured Reporting Standards provide a standard representation of images and reports. However, the message standards are not sufficient in themselves. Controlled terminology is needed to enable interchange of patient records and to facilitate the pooling of multi-center data for large-scale outcomes studies and clinical research. The ASGE has joined with European and Japanese colleagues to develop and publish a lexicon of endoscopic terminology. The lexicon is being tested now in a multi-center trial. In addition, the ASGE is collaborating with the DICOM Standards Committee to transform the endoscopic lexicon into a database structure that is suitable for use with the DICOM Visible Light and Structured Reporting Standards. The combination of an internationally accepted, tested and non-proprietary lexical standard and a DICOM message standard supporting endoscopic images and reports represents a powerful tool for clinicians to improve communication, research and the quality of care.*

## **INTRODUCTION**

Until recently, exchange of digital images and reports in Gastroenterology depended entirely on proprietary mechanisms. There was no consensus data interchange standard for endoscopic images and reports. To facilitate interchange of endoscopic images and reports in computerized record systems, the American Society for Gastrointestinal Endoscopy

(ASGE) joined with the American College of Radiology, the College of American Pathologists, the American Dental Association, the American Academy of Ophthalmology, and other organizations to develop the Visible Light<sup>1</sup> and Structured Reporting<sup>2</sup> Supplements of the Digital Imaging and Communications in Medicine (DICOM) Standard.<sup>3, 4, 5, 6</sup>

In endoscopy, as in radiology and other disciplines, visual signs are used to diagnose and manage diseases and functional disorders. There exists an extensive linguistic structure designed to convey endoscopic observations. Terms may be specific and precise, e.g. "a 1 centimeter pedunculated polyp", or may be imprecise, e.g. "patchy gastritis". The degree of precision impacts the reproducibility of any measurement. Similarly, the degree of semantic precision used to index clinical data impacts the reliability of information retrieval from the health care record.

Rapid advances in information system technology have exposed the need for detailed clinical classification and terminology systems, such as the Systematized Nomenclature for Human and Veterinary Medicine (SNOMED)<sup>7</sup>, the Clinical Laboratory Observations: Identifiers, Names, and Codes<sup>8</sup> database, and the Unified Medical Language System™ (UMLS. The United States National Library of Medicine, Bethesda, MD)<sup>9</sup>. A domain-specific clinical vocabulary permits information to be searched, sorted, summarized and retrieved.<sup>10</sup> Furthermore, controlled vocabulary permits the

construction of large clinical databases for retrospective and prospective clinical research.

The effort to create a common terminology in endoscopy is driven by the need to understand the nature of gastrointestinal disturbances. This effort to expand our knowledge is independent of information system technology. Yet, the requirements of information systems for standardization are crystallizing the need for professional consensus about terms. The Minimal Standard Terminology for Gastrointestinal Endoscopy,<sup>11</sup> developed by a consensus activity of the international gastrointestinal endoscopy community, is a direct result of the effort to standardize endoscopic reporting. The practical utility of this standardization activity can be divided into several categories.

1. Symbolic structure: Naming is an abstraction of a physical entity or a concept. Endoscopic terminology represents an abstraction of a visual observation. The accuracy of observer judgments, based on digital-image evidence is limited by the constraints of the devices that generate these images. Size estimates are distorted by lens magnification and distance. Assessment of color is limited by the wavelengths of light transmitted through the light guides, processing by the CCD and perception by the viewer. Example: "gastritis", a term dropped from the standard vocabulary for findings, was based on the assumption that the redness of the mucosa was associated with inflammation. Unfortunately, this symbol does not correlate with biopsies sufficiently to make it meaningful. In contrast, "varices" is a term which means more than simply dilated esophageal veins. Although both varices and dilated esophageal veins can be equivalent symbolic representations, varices implies portal hypertension and dilated veins may not be necessarily associated with increased portal pressure. The clinician fills in the gaps in the observation by making associations that are implied but not necessarily explicit.

2. Data Quality and Clinical Quality Assurance: Implied in the creation of a minimal standard terminology is the principle of the quality of the data. This notion of data quality is based on the principles of reproducibility or variance. The endoscopic diagnosis of gastritis is a case in point.

For many years endoscopists would see erythema in the stomach and label the observation gastritis. This endoscopic diagnosis was often without histologic correlation and implied that the patient had an inflammatory disorder of the stomach. Clinicians and patients were often misled because the endoscopist incorrectly defined a causal link between two distinct concepts: erythema and gastric mucosal inflammation. Studies that examined the relationship between redness and inflammation demonstrated that redness and inflammation could not be reproducibly linked. Thus, concept definitions in text and visual form reflect the dynamic nature of pathobiology and are the basis for any clinical lexicon based on visual observations.

3. Creation of large databases by data sharing: The use of large databases for the study of human diseases is increasing. At present the work is limited by the constraints of the databases created. These limitations are not those of technical manipulation but of the suitability of data available. Outcomes research requires that data have a high degree of reliability. The level of precision for studies is often defined by analysis of accumulated or retrospective data. The creation of a reference terminology system is mandatory for efforts in this type of research to go forward.

4. Clinical communication: Standardization of endoscopic terminology provides a common language for clinical research and clinical practice. Standardization reduces ambiguity, increases diagnostic accuracy and results in improved patient care making therapy more precise. The hazard of standardization is that it may codify ignorance and preclude an expansion of understanding by providing an appearance of precision.

#### **Minimal Standard Terminology**

In 1993 a consensus was reached among the members of the European, Asian and U.S. communities to establish a vocabulary based on the Minimal Standard Terminology© (MST) developed by the European Committee.<sup>11</sup> This terminology was presented as a Working Party Report at the World Congresses of Gastroenterology and Digestive Endoscopy.<sup>12</sup>

|                 |   |
|-----------------|---|
| Site            | Anatomic region   |
| Class           | Logical grouping of terms according to a morphologic relationship         |
| Term            | Observation or concept  |
| Attribute       | Characteristic of term which is significant in defining further the term. |
| Attribute Value | Modifying-concept.  |
| Therapy         | Intervention related to observation.                                      |

Table 1. Structural elements of the Minimal Standard Terminology.

The term or concept list is central to the minimal standard terminology. It is based on several simple principles. The terms should be as unambiguous as possible and they should be common. Precision is set at a level judged to be necessary by an expert panel. The definitions must be as precise as possible within the current state of knowledge. Endoscopic definitions must be textual and pictorial. Images facilitate consensus and advance the creation of a useful vocabulary. Finally, there must be some mechanism for updating the terminology utilizing version control. experience of a broad audience of endoscopists. This updating process requires some adjudicating process and a means of effective national and international revision.

Table 1 describes the structural components of the Minimal Standard Terminology terms are organized according to the type of examination. That is, esophago-gastro-duodenoscopy (EGD), colonoscopy and endoscopic retrograde cholangio-pancreatography (ERCP). To facilitate the hierarchical organization of terms, the Minimal Standard Terminology groups the terms so that the lists are constrained for particular purposes. For example, "lumen" includes a set of terms that describe the shape, tone, elasticity and distensibility of the cavity observed; "contents" includes any material contained within the organ; and "mucosa" includes characteristics of color, luster, texture, folds and secretions.

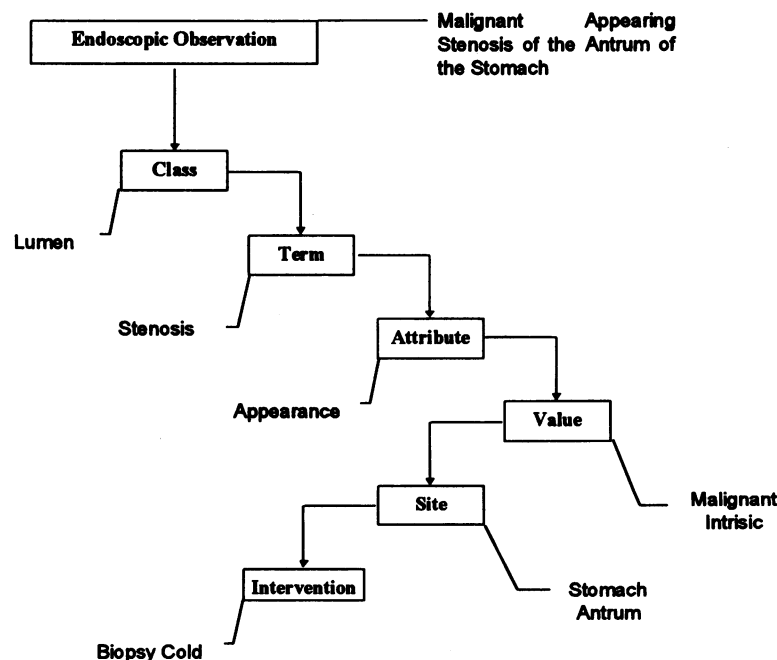


Figure 1. Semantic network specified by the Gastrointestinal Endoscopy Minimal Standard Terminology©.

| <b>MST© structural element</b>   | <b>SDM structural element</b>  |
|--|--|
| Site: anatomic region  | Template for the hierarchy of anatomic descriptors: (Region + Site + Epicenter + Locus). Anatomic concepts are represented in SDM Context Groups for region (e.g. stomach, colon), site (e.g. antrum, fundus), epicenter (e.g. extrinsic, intraluminal, wall), and locus (e.g. lumen, contents, mucosa).   |
| Class: logical grouping of terms according to a morphologic relationship             | Surface Lesion Class: Taxonomy of lesion morphology as viewed from the intraluminal-imaging perspective of endoscopy (i.e. raised, flat, excavated). Note: Some MST© Classes are represented in the SDM as anatomic observations; or as chemical or biological-product observations (in Context Groups) at the "Locus" level of the anatomic-site hierarchy (e.g. lumen, contents, mucosa); or as clinical diagnosis concepts (e.g. normal). |
| Term: observation or concept   | Context Groups for morphological, functional, or clinical diagnosis observations.  |
| Attribute: characteristic of term which is significant in defining further the term. | Templates for observation-description. SDM Context Groups of properties of morphological or functional observations. Note: Some MST© Attributes are represented in the SDM as functional, morphological, or clinical diagnosis observations.   |
| Attribute Value: modifying concept.  | Context Groups for morphological or functional observations.   |
| Therapy: intervention related to observation.  | Context Groups for names of diagnostic or therapeutic procedures from SNOMED <sup>7</sup> or Clinical LOINC <sup>8</sup> databases.  |

Table 2. Mapping of the Minimal Standard Terminology© structural elements into the SNOMED DICOM Microglossary. The MST© Site maps into a series of SDM Templates, Context Groups, and observational concepts.

### SNOMED DICOM Microglossary

The integration of gastrointestinal endoscopy into the patient imaging record is facilitated by the introduction of the SNOMED DICOM Microglossary (SDM). The SDM is a database of value sets for DICOM data elements.<sup>13,14,15</sup> The SDM supports DICOM Supplement 15: Visible Light (VL)<sup>1</sup> and Supplement 23: Structured Reporting (SR)<sup>2</sup> and other data-interchange specifications that utilize a similar interdependent message/terminology architecture.<sup>15</sup> In brief, the SDM enables specialists to create templates for the

content of specialized reports (such as upper gastrointestinal endoscopy, chest radiography, cardiac ultrasonography, first-trimester fetal ultrasonography, screening mammography) and suggest value-sets (pick-lists) for the coded-entry fields of the report.<sup>14</sup>

### TRANSFORMATION INTO SDM

Table 2 depicts the schema used for mapping the structural elements of the Gastrointestinal Endoscopy Minimal Standard Terminology© (Table

1) into the SNOMED DICOM Microglossary. For representation of MST© content in the SDM, the structural elements of the MST© are transformed into properties of SDM Templates, (i.e. concept-names for which context-dependent value-sets may be defined), SDM Context Groups, (i.e. context-dependent value sets for coded-entry data elements) or observational concepts (i.e. terms or phrases that are members of a Context Group). The content of the MST© is fully preserved in the transformation. The relationships defined by the semantic network of the Minimal Standard Terminology© (Figure 1) may be implemented by defining appropriate relationships between observations in DICOM structured-interpretation messages.

### SUMMARY

The conceptual schema for transformation of MST© structural elements into SDM structural elements and the representation of the content of the MST© in the SDM enables full implementation of the internationally-accepted reference terminology in DICOM implementations for gastrointestinal endoscopy. Representation of the MST© in the SDM enables the interchange of endoscopy images and semantically-rich multimedia reports using the interdependent message/terminology architecture that is provided by DICOM and the SDM.<sup>15</sup> The DICOM Structured Reporting Working Group and other professional specialty societies are developing similar domain-specific controlled terminology for other clinical and operational contexts. The SNOMED DICOM Microglossary, thus, can serve in a similar manner to tailor the generic Visible Light and Structured Reporting Standards for use in other clinical and operational contexts.<sup>14,15</sup>

### Acknowledgments

This work was supported in part by contracts from the National Library of Medicine. Additional funding was provided by the American College of Radiology, the American Society for Gastrointestinal Endoscopy, and the European Society for Gastrointestinal Endoscopy.

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